US3870894: ELECTRONIC SENSOR FOR TRIGGERING SAFETY DEVICES DURING THE CRASH OF VEHICLES

Inventor(s):
Brede; Uwe , Schwaig, Federal Republic of Germany
Flach; Karl-Egon , Cologne-Riehl, Federal Republic of Germany
Gawlick; Heinz , Furth, Bayern, Federal Republic of Germany
Hirschmann; Gunter , Volkach am Main, Federal Republic of Germany
Kreibich; Walter , Furth, Federal Republic of Germany

Applicant(s):
Dynamit Nobel Aktiengesellschaft, Troisdorf, Federal Republic of Germany
News, Profiles, Stocks and More about this company

Issued/Filed Dates: March 11, 1975 / Feb. 20, 1973

Application Number: US1973000334023

IPC Class: H01H 35/14;

Class:
Current: 307/009.1; 180/274; 307/121;
Original: 307/009; 180/091; 307/121; 340/052.H;

Field of Search: 307/10 R,9,121 340/52 H 180/82,91 280/150 AB 102/70.2

Priority Number(s): Feb. 19, 1972 DT1972002207831

Legal Status:
Show legal status actions

Abstract:

:
An electronic sensing system for triggering the activation of a safety mechanism of a vehicle during a vehicle collision. The system includes a piezoelectric transducer providing an output indicative of shock acceleration of the vehicle, an evaluating and safety circuit for processing the output of the transducer in accordance with predetermined dynamic deformation characteristics of the vehicle and for providing a triggering output signal to an ignition circuit for activating the safety mechanism such as an air bag system. The evaluating and safety circuit provides a triggering output signal depending upon whether at least one of a predetermined threshold value has been attained by the output signal of the transducer and that the value is maintained for a predetermined delay period.

Attorney, Agent, or Firm: Craig & Antonelli;

Primary/Assistant Examiners: Schaefer; Robert K.; Smith; William J.

We claim:

1. An electronic sensing system for triggering the actuation of a safety mechanism during a vehicle collision comprising acceleration pickup transducer means responsive to vehicle shock acceleration for providing an output signal indicative thereof, evaluating and safety triggering circuit means for processing the output signal of the transducer means in accordance with predetermined dynamic deformation characteristics of the vehicle, said evaluating and safety circuit means including threshold means providing first and second threshold values and for providing triggering output signal upon the output signal of said transducer means exceeding the first and second threshold values, and ignition circuit means responsive to the triggering signal for actuating the safety mechanism.

Background/Summary:

The present invention relates to an electronic sensor for the triggering of safety devices in vehicles of all kinds when the vehicles are driven against an obstacle or are in collision with another vehicle.

Triggering devices or systems for the actuation of safety mechanisms in automotive vehicles for the protection of the passengers during impact against an obstacle are known. However, these systems generally have triggering sensors formed by an acceleration-dependent, mechanical switching mechanism which in conjunction with an electric ignition circuit, ignites one or more electric igniting elements. Even in connection with an electronic monitoring and control circuit, these mechanical switches have substantial disadvantages, namely, on the one hand, there is a long delay in response time in the so-called "crash case" between the beginning of the deceleration upon impact and the actual triggering of the mechanism, and, on the other hand, the mechanism is highly sensitive to minor shock impacts and thus prone to be triggered accidentally.

It is an object of the present invention to provide a triggering sensor which, on the one hand, operates with great sensitivity and with minimum delay when an actual crash situation occurs and, on the other hand, does not lead to triggering in any case upon a harmless shock-like stress, vibrations, or the like.

In accordance with the present invention, there is provided an electronic sensor for the triggering of safety mechanisms during the impact of vehicles, which sensor is characterized by a piezoelectric acceleration pickup transducer means, an evaluation and safety switching circuit adapted to the dynamic deformation characteristic of the vehicle, as well as an ignition circuit which can be triggered on the basis of the generated piezoelectric voltage.

The evaluation and safety switching circuit of the present invention ensures that the sensor responds only in case of a crash situation. It has been found that in the case of a crash, the direction or polarity of the positive or negative acceleration, i.e. acceleration or deceleration, respectively, remains unchanged over a time period of at least approximately 10 milliseconds. When plotting the magnitude of the deceleration measured in the crash situation in dependence on the time, this curve, which is alsso called deceleration-time characteristic, does not have a zero transition at least during approximately the first 10 ms. The actual curve of the deceleration-time characteristic in the individual case depends on the vehicle speed upon impact, the mass of the vehicle, the proportion of kinetic energy converted into deformation work, etc. However, in any event, it is a characteristic phenomenon that the acceleration or deceleration does not change its polarity over a longer initial time period.

In contradistinction thereto, it has been found that in case of short-term disturbances by impact stresses, as they occur during driving, for example, by a thrown stone or in repair workshops by the action of impact tools, or in case of vibrations of the car body, the deceleration changes its polarity several times within a time period of, for example, 1-3 ms. Correspondingly, the curve of the associated deceleration-time characteristic thus exhibits an analogous number of zero transitions.

This basic difference in the deceleration-time characteristic can be detected, in an advantageous embodiment of the present invention, by means of a deceleration stage provided in the evaluation and safety switching circuit and can be employed for the defined triggering of the sensor. In accordance with a feature of the present invention, by setting the deceleration stage, in dependence on the deceleration-time characteristics of the respective vehicle type, at a delay time of between about 1 and 50 ms., for example 10 ms., the delay stage, as a consequence thereof, transmits the ignition signal to the ignition circuit associated therewith only in the case that the deceleration curve does not pass through zero during this period of 10 ms. The longer the delay period is set, the more secure is the sensor, on the one hand, against harmless impact and vibration stresses, whereas the sensor, on the other hand, also becomes less sensitive to already dangerous impact crash situations. For the usual types of vehicles and driving conditions, values in the range of between 3 and 6 ms. have been found to be optimum values for the delay time.

In order to prevent the sensor from responding at each normal braking operation, an electric component is inserted in the evaluation and safety switching circuit, according to a further feature of this invention. This electric component determines a lower threshold value for the deceleration and can be, in principle, between 2 and 50 g. or thereabove. However, it is advantageous to fix this value in the range of 2-10 g. The threshold value is adapted to the deformation behavior of the vehicle and provides that the triggering takes place only if the deceleration curve, after exceeding the acceleration threshold value, remains above this value at least for the predetermined deceleration period.

It is a further advantageous feature to provide the evaluation and safety circuit with a filter element which filters out the higher frequency oscillations which are superimposed on the deceleration-time curve in case of a crash. In order to trigger the sensor, the signal produced by the acceleration pickup transducer means is amplified and can be used for the control of a triggering device, the output signal of which is applied to the timer of the delay stage. However, according to another feature of this invention, the ignition circuit can also be triggered by an integrator, during which step a voltage is produced which is proportional to the integral of the deceleration-time curve. This voltage is then capable of triggering the ignition circuit if it lies above the triggering threshold fixedly set in the integrator, which triggering threshold is determined in correspondence with the deformation characteristic of the respective vehicle type and the other variables. A set integral value corresponds to the set tripping threshold, so that the actual tripping takes place, at varying speeds, also in accordance with varying delay times. Thus, the delay time is dependent on the speed, in this connection. In this embodiment, the integrator simultaneously serves as the filter and the delay stage. The integrator can advantageously be formed from the triggering circuit by an appropriate choice of the circuit components.

The natural frequency of the piezoelectric pickup transducer means is selected to be very high, preferably between 10 and 100 kilohertz so that every signal is transmitted, even one of a high frequency such as result from minor impacts or by vibrations of the body of an automotive vehicle. In order to increase the sensitivity of the piezoelectric pickup transducer means, it is advantageous to bias the piezoelectric pellet of the transducer.

In accordance with a further feature of the present invention, a reserve energy source is advantageously provided, for example in the form of a capacitor, which ensures that even in the event of a possible failure of the vehicle circuit network, the sensor still remains functional for a certain time period, for example 30 seconds to 5 minutes.

In order to control the functionality of the sensor and to avoid erroneous trippings, a control unit is advantageously provided which, upon the failure of any of the components, signals a disturbance and simultaneously prevents erroneous triggering due to this failure.